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the accompanying figure of the curve of frequency of astronomical publications. Notice in the curve the dates of the discovery of Neptune (1846), of the transit of Venus (1874), of the French Revolution (1794), of the wars of Napoleon (1815), etc.

The number of authors per century is :—

1601-1700 . . . . .	88
1701-1800 . . . . .	571
1801-1880 . . . . .	2,901

The number of articles per century is :—

1601-1700 . . . . .	396
1701-1800 . . . . .	3,479
1801-1880 . . . . .	18,970

The proportion of articles per author is :—

1600-1699 . . . . .	4.5 articles per author.
1700-1799 . . . . .	6.1 “ “ “
1800-1880 . . . . .	6.6 “ “ “

The following list of authors who have furnished more than a hundred articles conveys its own lessons :—

	Articles.	Per year.
1. Secchi . . . . .	360, 1846-1878 . . . . .	10.9
2. Lalande . . . . .	299, 1743-1807 . . . . .	4.6
3. Zach, F. X. de . . . . .	252, 1785-1832 . . . . .	5.3
4. Bessel . . . . .	243, 1805-1846 . . . . .	5.8
5. Flammarion . . . . .	210, 1863-1881 . . . . .	11.1
6. Birt . . . . .	207, 1857-1881 . . . . .	8.3
7. Proctor . . . . .	178, 1865-1881 . . . . .	10.5
8. Gruithuisen . . . . .	177, 1817-1850 . . . . .	5.2
9. Faye . . . . .	177, 1846-1881 . . . . .	4.9
10. Mädler . . . . .	169, 1831-1870 . . . . .	4.2
11. Le Verrier . . . . .	164, 1839-1877 . . . . .	4.2
12. Cassini, J. D. . . . .	143, 1664-1709 . . . . .	3.1
13. Wolf, R. . . . .	142, 1844-1881 . . . . .	3.7
14. Laplace . . . . .	135, 1772-1827 . . . . .	2.4
15. Airy . . . . .	134, 1826-1881 . . . . .	2.4
16. Bode . . . . .	124, 1775-1826 . . . . .	2.4
17. Lockyer . . . . .	120, 1864-1881 . . . . .	6.7
18. Encke . . . . .	117, 1819-1865 . . . . .	2.5
19. Arago . . . . .	110, 1814-1853 . . . . .	2.8
20. Delambre . . . . .	107, 1783-1822 . . . . .	2.7
21. Heis . . . . .	106, 1847-1877 . . . . .	3.4
22. Euler, L. . . . .	105, 1735-1783 . . . . .	2.1
23. Hansen . . . . .	105, 1824-1874 . . . . .	2.1

It will be evident that this book is indispensable to every astronomical library; and the smaller the library, the more important such a work becomes. Much of the material of this work has been incorporated in another work by M. Houzeau : *Vade-mecum de l'astronome*, Brussels, 1882; 28+1,144 p. 8vo.

For each of these works, astronomy and every astronomer owes a debt of gratitude.

EDWARD S. HOLDEN.

#### THE FORMATION OF COAL.

*Mémoire sur la formation de la houille*; par Grand'Eury. Paris, Dunod. 1882. 196 p., 4 pl. 8°.

This work of Grand'Eury, reprinted from the *Annales des mines* for 1882, exposes upon

the origin of the coal such an array of facts, considerations, hypothetical subjects of inquiries, and assertions based upon long and careful researches, and these are scattered in so many chapters, that the only possible way to give an idea of the scope of the work is to quote the titles of the essential divisions.

The first part considers the botany and stratigraphy of the carboniferous formations, in seven chapters: 1°. State of disintegration of the plants; 2°. Distribution of the remains of fossil plants in the rocks; 3°. Structure of coal, and its organic composition; 4°. Trunks and stipes *in situ*; fossil forests and carboniferous forests, their relation to coal-beds; topographical circumstances; 5°. Examination of the fossil stems and of the lignite, and their comparison with coal-beds; 6°. Peat-bogs and other deposits of vegetable matters; 7°. Critical review of the divers theories on the formation of coal.

The second part treats of the physical and chemical characters as follows: 1°. State of the vegetable remains in coal; 2°. Physical properties of coal; 3°. Chemical composition; 4°. Comparison of the characters of fossil wood, lignite, and peat; 5°. Circumstances which have fostered the transformation of coal; 6°. Conclusions and *résumé*.

Each of the above chapters is subdivided into a number of sections, ninety in all, each with a title, and a short exposition of the contents. From his long researches in the coal-fields of Europe, the author comes to the conclusion that the matter composing the coal is of vegetable origin, derived from plants grown *in situ*, rapidly decomposed under atmospheric influence, more slowly transformed by maceration, and later washed out by torrential floods of rain, transported and deposited in depressions or basins surrounded by swampy forests,—the coal, in his opinion, being the result of stratification like the rocks. Besides the many other objections which could be made against this theory (a theory suggested to the author by the small areal surface occupied by the coal-deposits of France) we may mention the wide extent of the American coal-fields, and the continuity of some of the beds which cover areas of many hundred square miles, as sufficient to contradict the assertions of the distinguished author. Nevertheless, the book is very instructive as exposing a mass of facts concerning the divers phases of a formation, which, though often considered by science, are still, some of them at least, unexplained.